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(72) Inventors:
• **Cotti, Maurizio**
40017 San Giovanni in Persiceto, Bologna (IT)
• **Bencivenni, Marco**
40127 Bologna (IT)
• **Neri, Armando**
40139 Bologna (IT)

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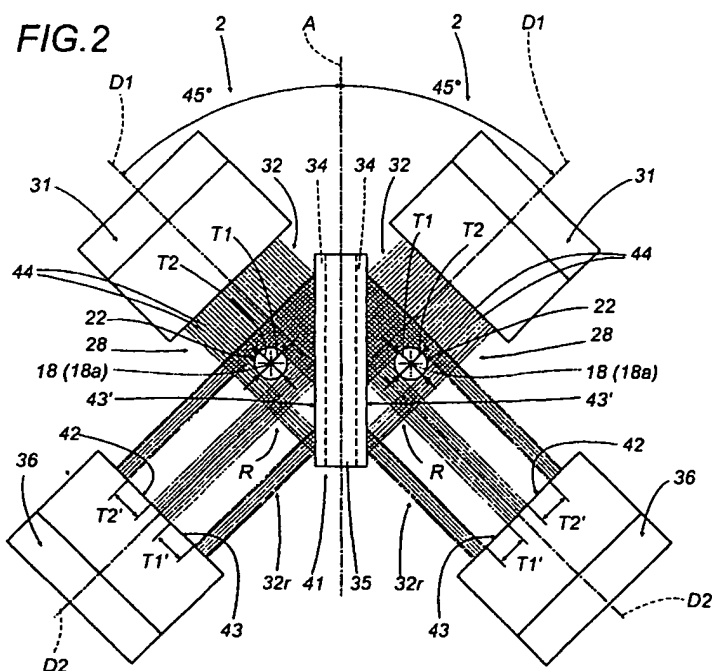
(71) Applicant: **G.D SOCIETA' PER AZIONI**
I-40133 Bologna (IT)

(74) Representative: **Pederzini, Paolo**
c/o **BUGNION S.p.A.**
Via Golto, 18
40126 Bologna (IT)

(54) **A unit for checking the transverse dimensions of bar-shaped products**

(57) The invention relates to a unit for checking the transverse dimensions of bar-shaped products as they feed lengthways along a path (18, 18a) in a feed direction (40); the unit is equipped with a device (31) that emits electromagnetic waves and that is designed to direct at least one electromagnetic beam (32) incident on the path (18, 18a) in a first direction (D1), a receiving device (36) associated with the emitting device (31) and

used to check at least one transverse dimension of the products (22), and a device (41, 34) that reflects the beam (32), that is located along the first direction (D1) on the side opposite the emitting device (31) in relation to the feed path (18, 18a) and that is designed to produce a corresponding beam (32r) of electromagnetic wave directed at the receiving device (36) along a second direction (D2).



Description

[0001] The present invention relates to a unit for checking the transverse dimensions of bar-shaped products.

[0002] The invention can be applied to good advantage in the tobacco industry to which the description below refers but without thereby restricting the scope of the invention.

[0003] The invention can be used in particular on single or twin line cigarette making machines to check the transverse dimensions of continuous rods of cigarette, filter and similar items or of the related lengths of them.

[0004] A customary, single line, cigarette rod maker usually envisages an essentially vertical chimney fed from below by a continuous flow of tobacco particles and having at its top end a suction band on which a continuous tobacco rod is formed.

[0005] This suction band is designed to feed the continuous tobacco rod along a defined path to a garniture at the infeed end of which the tobacco rod is transferred to a garniture tape which carries the cigarette paper.

[0006] The garniture tape wraps the cigarette paper round the tobacco rod to form a cylindrical bar-shaped product or continuous cigarette rod which is fed along a defined path to a cut-off station where this cigarette rod is cut into individual cigarette lengths by a rotary blade cutting device.

[0007] Along the above mentioned path, there is usually a checking unit designed to check at least one transverse dimension of the cigarette rod and forming part of a detecting unit which ensures that the diameter of the cigarette rod is to specifications.

[0008] The above description also applies to each of the two individual lines of a customary, twin line cigarette making machine where the two lines run parallel at a very short distance from each other for known reasons of functional and structural optimization.

[0009] The said checking devices are usually equipped with two optical detectors, each of which is designed to check a transverse dimension of the products in a corresponding given direction. Both the checking devices comprise a light beam emitter and a corresponding receiver placed opposite each other on opposite sides of the path along which the products are travelling. The two emitters are aligned with the corresponding receivers in two different directions at right angles to the above mentioned feed path, incident on the products and with an angular interval between them such that they can generate the signals necessary to indicate the transverse dimensions of the products.

[0010] A checking unit of the type described above, although capable of providing a transverse dimension with a satisfactory degree of reliability, is relatively expensive because of the high number of components used and, above all, is too large to be fitted in all cigarette making machines of known kind. In particular, it is usually unsuitable for customary twin-line cigarette

making machines because the two lines are so close to each other that there is not enough space between them to arrange the emitter and receivers around the rod in a configuration such as that described above.

5 [0011] The aim of the present invention is to provide a unit for checking the transverse dimensions of essentially cylindrical products that is reliable and, at the same time, simple, economical and small enough to be used both in single and twin line cigarette making machines.

10 [0012] The present invention provides a unit for checking the transverse dimensions of bar-shaped products as they feed along a defined feed path and in a defined direction, the unit comprising at least one device that emits electromagnetic waves and that is designed to direct a beam of electromagnetic waves in a first given direction transverse to the said path and at least one receiving device associated with the said emitter; the said unit being characterized in that it comprises means for reflecting the said beam located opposite the emitter on the other side of the said feed path.

15 [0013] The invention will now be described with reference to the accompanying drawings which illustrate a preferred embodiment and in which:

- 25 - Figure 1 is a schematic side view, partially in the form of a block diagram and with some parts cut away to better illustrate others, of a twin line cigarette making machine in which each line is equipped with a preferred embodiment of the unit made according to the present invention;
- 30 - Figure 2 is a cross section, with some parts cut away in order to better illustrate others, of a detail of the machine shown in Fig. 1;
- 35 - Figure 3 is a plan view, with some parts in cross section and some parts cut away in order to better illustrate others, of the detail shown in Fig. 2.

[0014] With reference to Fig. 1, the numeral 1 indicates as a whole a cigarette making machine with two twin cigarette making lines (only one of which is illustrated in Fig. 1) working in parallel and placed side by side essentially symmetrical about a vertical plane A (shown in Figs. 2 and 3). In the description which follows, reference will be made to only one of the lines 2 since the two lines, besides being identical, are essentially separate from each other except for a few parts which will be expressly specified below.

[0015] With reference to Fig. 1, the line 2 comprises a tobacco feed unit 3 and a paper feed unit 4.

40 [0016] The illustration shows only the end part of the unit 3, comprising an outlet 5 of a chimney 6 which carries the tobacco for both lines upwards, and a conveyor 7 extending along a tobacco feed path 8 between the outlet 5 and a tobacco discharge station 9.

55 [0017] The conveyor 7 comprises a band 10 wound in a loop round two essentially horizontal rollers 11 forming a lower conveyor branch 10a, and a suction chamber 12 located between the two rollers 11 inside the loop

and designed to create a vacuum within the chimney 6, through the outlet 5 and a plurality of through holes (not illustrated) made in the band 10, so as to form a continuous rod 13 of tobacco adhering to the branch 10a.

[0018] Along the tobacco conveying path 8, underneath the branch 10a, there is a rotary trimming device 14 designed to remove (in known manner) the excess tobacco from the rod 13 so as to give the rod 13 the required profile.

[0019] The paper feed unit 4 comprises a conveyor belt 15 designed to hold by suction a tape of cigarette paper 16 and to feed it along a path 18 which passes through the tobacco discharge station 9 where the rod 13 just trimmed is placed on the tape 16. The tape 16 is one of the two longitudinal halves of a tape 17 which is cut through the longitudinal centre line during machine operation by a cutting device 38 (of known type), which serves both lines 2, after being unwound from a bobbin 19 at an unwinding station 20, which also serves both lines 2.

[0020] Along the path 18, there is a garniture 21 (of known type) designed to fold the tape 16 around the tobacco rod 13. Along the garniture 21, the two longitudinal edges of the cigarette paper tape 16 are folded over and glued to each around the tobacco (by known means which are not illustrated) in such a way as to form a continuous cigarette rod 22.

[0021] Downstream of the garniture 21 in a rod 22 feed direction 40, the path 18 runs through a cut-off station 23 where a rotary cutting device 24, which serves both lines 2, cuts the rod 22 into equal, preset cigarette lengths.

[0022] A section 18a of the path 18 between the garniture 21 and the cut-off station 23 is defined by a bracket 26 to guide the rod 22 at which there is located an apparatus for checking and correcting the transverse dimensions of the rod 22. This apparatus, labelled 27 as a whole and illustrated schematically as a block, comprises a checking unit 28, located along the section 18a, a correction device 29 (of known type), located in the area of the garniture 21, and a control unit 30 (also of known type), located between the unit 28 and the device 29 and designed to process the signals generated by the unit 28 and to control the device 29 accordingly.

[0023] As shown in Figs. 2 and 3, in which both cigarette rods 22 can be seen in the respective lines 2, each of the two checking units 28 comprises a laser emitting device 31, located opposite the corresponding section 18a on the other side of the plane A and is designed to project a plane-polarized laser beam 32 in a direction D1 that makes a 45° angle with the plane A itself.

[0024] Figure 3, in particular, shows that the emitting device 31 is oriented in such a way that the plane-polarized beam 32 it emits strikes the section 18a of the path 18 at right angles through a break 33 in the corresponding bracket 26.

[0025] As shown in Figs. 2 and 3, each checking unit 28 also comprises an optical reflecting device 41 con-

sisting of a flat reflecting surface 34 located opposite the corresponding emitting device 31 on the other side of the section 18a.

[0026] The surface 34 is parallel to the plane A so that it reflects the corresponding beam 32 to create a reflected beam 32r that is co-planar with the beam 32 and is directed in a direction D2 at right angles to the direction D1 to strike the section 18a of the path 18 at right angles through the opening 33 in the corresponding bracket 26. In particular, the surface 34 defines an outside face of a thin wall 35 common to both lines 2 and whose plane of symmetry is plane A.

[0027] Each checking unit 28 also comprises a receiving device 36 located opposite the corresponding surface 34 on the other side of the section 18a.

[0028] In each checking unit 28, the beam 32 and the reflected beam 32r have an amplitude of more than twice the estimated diameter of the corresponding rod 22 and overlap in such a way as to form an essentially triangular zone R of intersection crossed by the rod 22.

[0029] Each checking unit 28, lastly, comprises a compressed air cleaning device 37 (of known type) supported by the wall 35 and directed at the surface 34 to keep the surface 34 clean.

[0030] During machine operation, the band 10 feeds the tobacco rod 13 along the path 8, allowing the rod 13 to pass through the above mentioned trimming device 14 to reach the garniture 21 where the continuous cigarette rod 22 is formed.

[0031] As shown in Figs. 1, 2 and 3, as the continuous cigarette rod 22 leaves the garniture 21, moving along the path 18 in the direction 40, it reaches the aforesaid checking unit 28 and crosses the zone R of intersection of the beam 32 emitted by the device 31 and the corresponding beam 32r reflected by the surface 34.

[0032] As shown by Fig. 2 in particular, where the rod 22 crosses the zone R, it casts two separate shadows 42 and 43 in the reflected beam 32r. This is because when the rod 22 crosses the said zone R, it is struck by a portion of the beam 32 emitted by the emitting device 31 in the first direction D1 and, simultaneously, by a portion of the beam 32r reflected by the surface 34 in a second direction D2 and, consequently, creates a break both in the beam 32 and in the reflected beam 32r.

[0033] The break in the beam 32 produces on the reflecting surface 34 a shadow zone, labelled 43', which is reflected by the surface 34 to reach the receiving device 36 in the form of a projected shadow 43. The break in the portion of reflected beam 32r, on the other hand, produces a shadow zone 42 directly on the receiving device 36.

[0034] In the embodiment illustrated in Fig. 2, the transverse amplitude T1' of the projected shadow 43 is equal to the transverse dimension of a first diameter T1 of the rod 22 measured across the direction D1, while the transverse amplitude T2' of the shadow 42 is equal to a second diameter T2 of the rod 22, at right angles to the first, measured across the direction D2.

[0035] The receiving device 36, on receiving the beam 32r, outputs two signals, corresponding to the shadows 42 and 43 to the control unit 30 which, after calculating the diameter of the rod 22 or the two diameters T1 and T2, as shown in Fig. 2, compares the diameters with a preset reference value and, if necessary, controls the correction device 29.

[0036] On leaving the checking unit 28, the rod 22 is fed to the cut-off station 23 where the rotary cutting device 24 cuts it into the individual cigarette lengths 25.

[0037] In another embodiment, the checking unit 28 may envisage that the emitting device 31 emits a beam 32 of electromagnetic waves consisting of a plurality of individual parallel rays 44 emitted in succession according to a defined temporal scanning which makes it possible to identify the transverse dimensions T1 and T2 of the continuous cigarette rod 22 by measuring the two time intervals during which the reflected beam 32r is broken.

Claims

1. A unit for checking the transverse dimensions of bar-shaped products as they feed along a defined feed path (18, 18a) and in a defined direction (40), the unit (28) comprising at least one device (31) that emits electromagnetic waves and that is designed to direct a beam (32) of electromagnetic waves in a first given direction (D1) transverse to the said path (18, 18a) and at least one receiving device (36) associated with the said emitter (31); the said unit (28) being characterized in that it comprises means (41, 34) for reflecting the said beam (32) located opposite the emitter (31) on the other side of the said feed path (18, 18a).
2. A unit for checking the transverse dimensions of bar-shaped products as they feed along a defined feed path (18, 18a) and in a defined direction (40), the unit (28) comprising at least one device (31) that emits electromagnetic waves and that is designed to direct a beam (32) of electromagnetic waves in a first given direction (D1) transverse to the said path (18, 18a) and at least one receiving device (36) associated with the said emitter (31); the said unit (28) being characterized in that it comprises means (41, 34) used to reflect the said beam (32) and arranged and shaped in such a way, relative to the said path (18, 18a) and to the emitting and receiving devices (31, 36), as to enable the said emitting and receiving devices (31, 36) to check at least two separate transverse dimensions (T1, T2) of the said products (22).
3. The checking unit according to claim 1 or 2 characterized in that the said emitting and receiving devices (31, 36) are located on the same side of the path (18, 18a) as the said emitting device (31).
4. The checking unit according to claim 3 characterized in that the said reflecting means (41, 34) produce at least one reflected beam (32r) of electromagnetic waves in a second given direction (D2); the said receiving device (36) being located on the trajectory of the said reflected beam (32r).
5. The checking unit according to any of the foregoing claims from 1 to 4 characterized in that the said beam (32) produced by the emitting device (31) and the said reflected beam (32r) produced by the reflecting means (41, 34) are essentially plane-polarized beams, both transverse to the said path (18, 18a).
6. The checking unit according to any of the foregoing claims from 1 to 5 characterized in that the said beam (32) produced by the emitting device (31) and the said reflected beam (32r) produced by the reflecting means (41, 34) are essentially co-planar and form an essentially triangular zone (R) of intersection, the said path (18, 18a) crossing the said emitted and reflected beams (32, 32r) within the said zone (R) of intersection.
7. The checking unit according to claim 5 characterized in that the said beam (32) produced by the emitting device (31) has an amplitude, measured transversely to the said first given direction (D1), that is more than twice the transverse dimension (T1, T2) of the said products (22).
8. The checking unit according to any of the foregoing claims from 4 to 7 characterized in that the said first direction (D1) and the said second direction (D2) are essentially at right angles to each other.
9. The checking unit according to any of the foregoing claims from 1 to 8 characterized in that the said reflecting means (41, 34) comprise at least one wall (35) with a flat reflecting surface (34) that is essentially parallel to the said path (18, 18a) along the said given feed direction (40) of the said products (22).
10. The checking unit according to any of the foregoing claims from 1 to 9 characterized in that the said receiving device (36) is designed to check, within the beam (32r) of waves reflected by the said reflecting means (41, 34), two separate shadows (42, 43) defined by the incidence upon the said products (22) of the beam (32) of waves produced by the said emitting device (31) and of the beam (32r) of waves reflected by the said reflecting means (41, 34), each shadow corresponding to a transverse dimension (T1, T2) of the products (22) themselves.

11. The checking unit according to any of the foregoing claims from 1 to 10 characterized in that the said beam (32) of electromagnetic waves produced by the said emitting device (31) consists of a plurality of individual parallel rays (44) emitted in succession according to a defined temporal scanning. 5
12. The checking unit according to any of the foregoing claims from 1 to 11 characterized in that it comprises means (37) for cleaning the said reflecting means (41, 34). 10
13. The checking unit according to claim 12 characterized in that the said cleaning means (37) are of the compressed air type. 15
14. The checking unit according to any of the foregoing claims from 1 to 13 characterized in that the said emitting device (31) emits a laser beam (32). 20
15. A single-line cigarette or cigarette filter making machine in which a single cigarette or filter rod is fed along a defined feed path (18, 18a) and direction (40) characterized in that it comprises a checking unit (28) as claimed in any of the foregoing claims from 1 to 14. 25
16. A unit for checking the transverse dimensions of bar-shaped products as they move along two separate given feed paths (18, 18a) in a given common direction (40), characterized in that it comprises reflecting means (41, 34) located between the said two paths (18, 18a) and comprising, for each of the two paths (18, 18a), a flat reflecting surface (34) facing a respective path (18, 18a) and also characterized in that it comprises, opposite the reflecting surface (34) on the other side of the related path (18, 18a), a device (31) that emits a beam (32) of electromagnetic waves and a device (36) that receives a beam (32r) of the electromagnetic waves reflected by the reflecting surface (34) in order to check the transverse dimensions (T1, T2) of a product (22). 30
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17. The checking unit according to claim 16 characterized in that it has a structure that is essentially symmetrical about a plane of symmetry (A) located between the said two paths (18, 18a) and parallel to the said reflecting surfaces (34). 45
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18. A twin-line cigarette or cigarette filter making machine in which two separate cigarette or cigarette filter rods are fed along two separate given feed paths (18, 18a) in a given common direction (40) characterized in that for each individual rod (22) it comprises a checking unit (28) as claimed in any of the foregoing claims from 1 to 14. 55

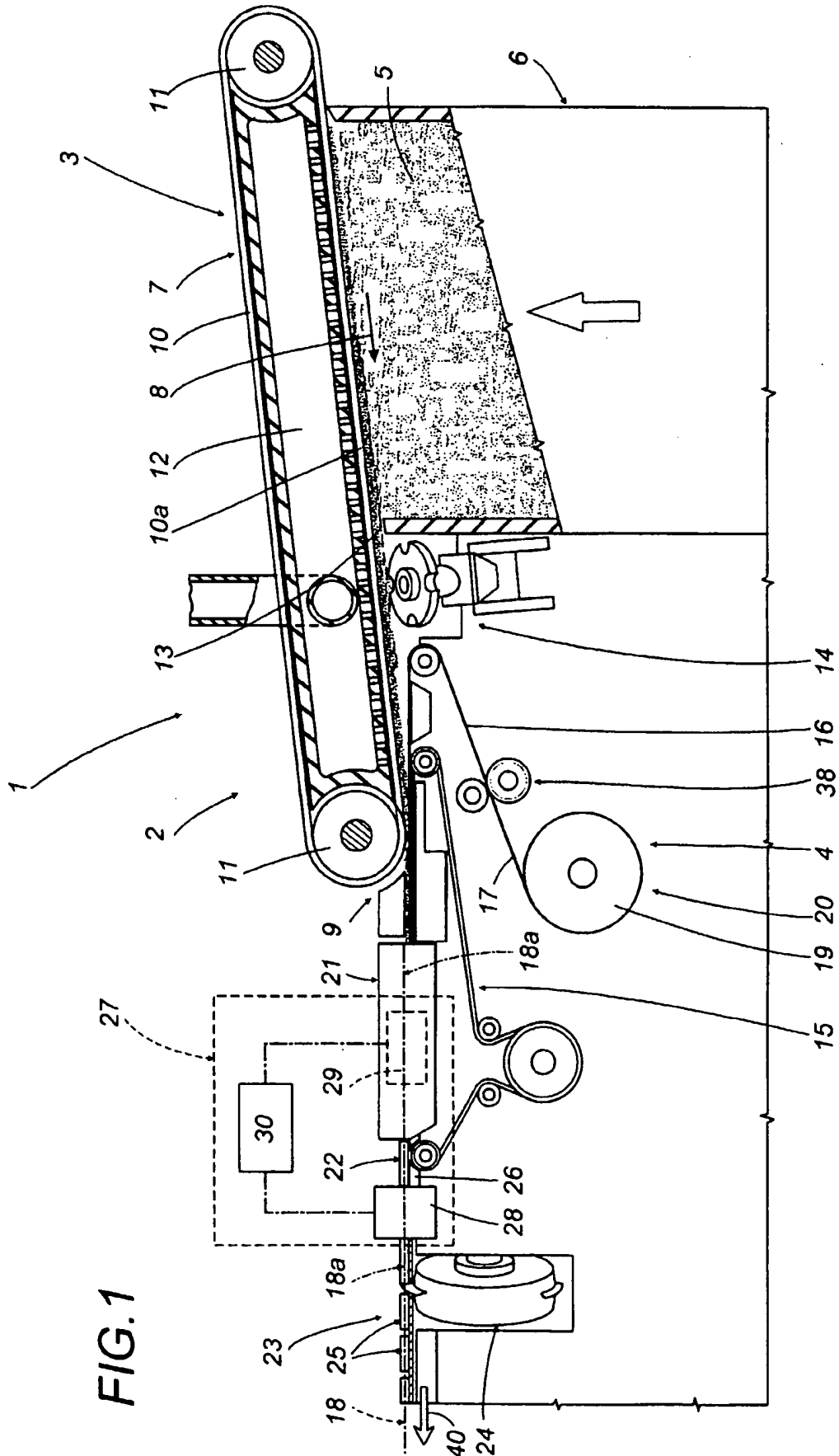


FIG.2

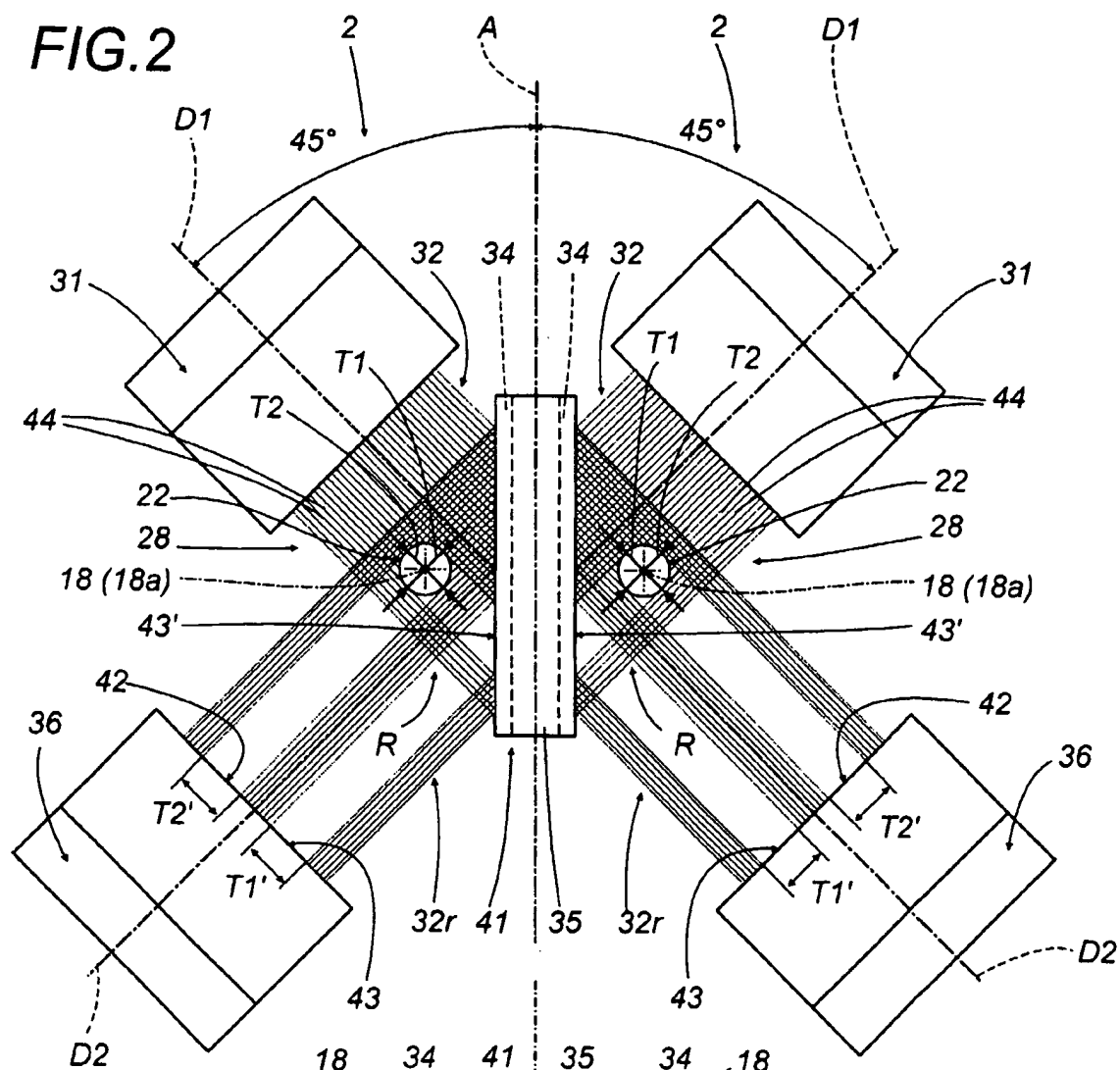
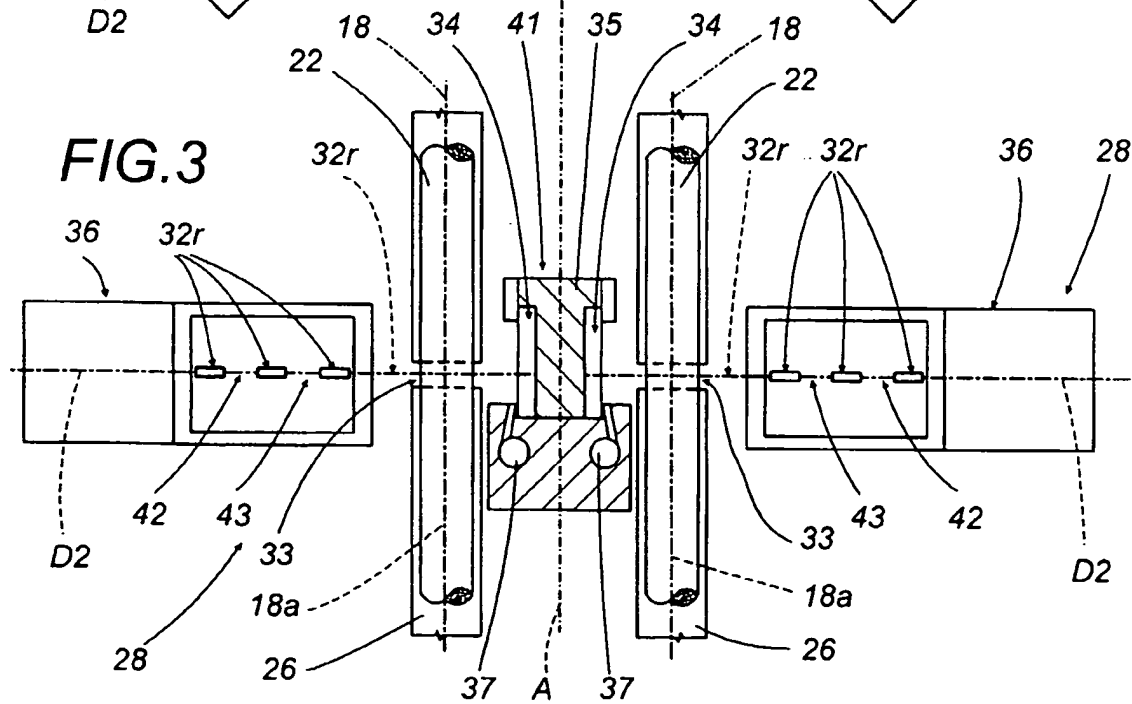


FIG.3





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0543

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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A	EP 0 656 181 A (G.D. SOCIETA PER AZIONI) 7 June 1995 * figures 4, 5 *	16	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 January 1999	Examiner Riegel, R
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 98 83 0543

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